PATENT ABSTRACTS OF JAPAN

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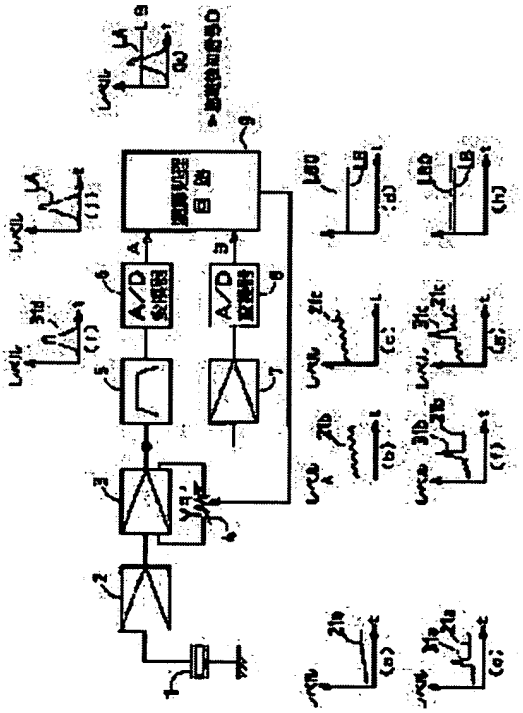
(54) THEFT DETECTOR

(57)Abstract:

PROBLEM TO BE SOLVED: To positively detect only the vibration generated when actually touching a car body, while positively eliminating noise and to be applicable to all car models by making automatic sensitivity adjustment.

SOLUTION: An arithmetic processing circuit 9 controls electronic volume 4 on the basis of a noise component detection signal B obtained from an analog- to-digital converter 8. The noise component from environmental noise detected by a vibration sensor 1 and amplified by amplifying circuits 2, 3 is thereby limited to a fixed level, and the level of a theft vibration detection signal A obtained from the analog-to-digital converter 6 is compared with the average value of the levels of the noise component detection signals in a fixed period. A theft detection signal is outputted when the level of the theft vibration detection signal A exceeds the average value of the levels of the noise component detection signals in the fixed period.



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* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1] The sway sensor which detects the oscillation which joins a car etc., and the 1st amplifying circuit which amplifies the signal detected with the sway sensor, The amplification factor control circuit which controls the amplification factor of this 1st amplifying circuit, and the filter circuit which removes the noise component by ambient noise from the output signal of said 1st amplifying circuit, The 1st digital disposal circuit which changes the output signal of this filter circuit into a digital signal, and inputs it into a data-processing circuit, The 2nd amplifying circuit which amplifies the output signal of said 1st amplifying circuit further, It has the 2nd digital disposal circuit which changes into a digital signal the signal amplified by this 2nd amplifying circuit, and inputs it into said data-processing circuit. Said data-processing circuit By controlling said amplification factor control circuit based on the 2nd input signal acquired from said 2nd digital disposal circuit While restricting the noise component which is detected by said sway sensor and amplified by said 1st amplifying circuit to fixed level Theft detection equipment characterized by judging the existence of a theft based on the 1st input signal acquired from said 1st digital disposal circuit, and said 2nd input signal, and outputting a theft detection signal.
[Claim 2] Theft detection equipment according to claim 1 said whose amplification factor control circuit is electronic volume.
[Claim 3] Said data-processing circuit is theft detection equipment according to claim 1 or 2 characterized by outputting a theft detection signal when the average value of a fixed period of the level of said 2nd input signal is compared with the level of said 1st input signal and the level of the 1st input signal is over said average value.
[Claim 4] Said data-processing circuit is theft detection equipment according to claim 3 characterized by not outputting a theft detection signal when the condition that the level of the 1st input signal exceeds said average continues continuously.
[Claim 5] Said data-processing circuit is theft detection equipment according to claim 3 or 4 characterized by not outputting a theft detection signal when the time amount to which the level of the 1st input signal is over said average is measured and measurement time amount is over predetermined time.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention begins a passenger car, a operating vehicle, and large-size cars, such as a bus and a truck, and relates to the theft detection equipment which is a means for detecting that the doubtful person approached the car etc. in anti-theft system, such as a car containing agricultural implement and machinery, a construction equipment, etc.
[0002]
[Description of the Prior Art] There are some which consist of theft detection equipment which detects that the doubtful person approached the car etc. as an example of the conventional anti-theft system, and outputs a theft detection signal, and alarm information equipment which performs alarm information with light, a sound, etc. when a theft detection signal is received.
[0003] There is a thing equipped with the sway sensor which detects the oscillation generated when people wrench doors, such as a car, open or ride on a car etc. as an example of this theft detection equipment, and outputs an oscillating detection signal, and the dispatch circuit which outputs a theft detection signal to alarm information equipment based on the oscillating detection signal outputted from this sway sensor.
[0004] When larcenists, such as a car, are going to steal a supply in the car and wrench doors, such as a car, open by preparing such anti-theft system, abnormalities, such as a car by oscillation, can be detected with the theft detection equipment attached in the car etc., and alarm information equipment can perform alarm information.
[0005] The conventional example of circuitry of such theft detection equipment is shown in drawing 5 .
[0006] The sway sensor 51 with which this theft detection equipment detects the oscillation which joins a car etc., The amplifying circuit 52 of the preceding paragraph which amplifies the signal detected with this sway sensor 51, and the latter amplifying circuit 53, A/D converter 54 which changes into a digital signal the signal amplified by the amplifying circuit 53 of this latter part, The existence of a theft was judged based on the output signal of this A/D converter 54, and it has the data-processing circuit 55 which outputs a theft detection signal. Between the amplifying circuit 52 of the preceding paragraph, and the latter amplifying circuit 53 It has the composition that the fixed volume (attenuator) 56 for controlling an amplification factor was formed. The fixed volume 56 is manual operation, and when owners, such as a car, operate this fixed volume 56, it can change the sensibility of theft detection equipment freely.
[0007]
[Problem(s) to be Solved by the Invention] With such theft detection equipment of circuitry, since all oscillations that the sway sensor 51 gathered are amplified and it inputs into the data-processing circuit 55 even if it operated the fixed volume 56 and being adjusted to suitable amplification degree, a noise oscillation in case an electric car passes near [in which this theft detection equipment was carried for example] the car, an oscillation in case rain is equivalent to a car body, etc. will be gathered. In this case, since the sensitivity level was fixed, it had the problem that possibility that incorrect detection of

outputting a theft detection signal also in response to such an oscillation will occur was high in the data-processing circuit 55.
[0008] Moreover, the reinforcement of a car body and the thickness of a griddle in which a sway sensor 51 is attached differ from each other greatly by the light vehicle and the high-class car. therefore -- for example, even if it detects the oscillation of the rain equivalent to a car body with a sway sensor 51, the oscillating wave turns into a completely different wave by the case where the sway sensor 51 is attached in the car body of a light vehicle, and the case where it is attached in the car body of a high-class car. Therefore, with conventional theft detection equipment, processing in the data-processing circuit 55 was divided into the processing corresponding to a light vehicle, and the processing corresponding to a high-class car, and was performed. That is, the light vehicle used the theft detection equipment with which sensibility was set to light vehicles, and the high-class car needed to use the theft detection equipment with which sensibility was set to high-class cars, and had the problem that it could respond to no types of a car with one kind of theft detection equipment.
[0009] It is in being able to apply to all types of a car by having been originated that this invention should solve this trouble, when the object performs sensitivity settling automatically, and removing a noise certainly, and offering the theft detection equipment which can detect only the oscillation when touching a car body actually certainly.
[0010]
[Means for Solving the Problem] In order to solve the above-mentioned technical problem, the theft detection equipment of this invention The sway sensor which detects the oscillation which joins a car etc., and the 1st amplifying circuit which amplifies the signal detected with the sway sensor, The electronic volume which is the amplification factor control circuit which controls the amplification factor of this 1st amplifying circuit, The filter circuit which removes the noise component by ambient noise from the output signal of the 1st amplifying circuit, The 1st digital disposal circuit which changes the output signal of this filter circuit into a digital signal, and inputs it into a data-processing circuit, It has the 2nd amplifying circuit which amplifies the output signal of the 1st amplifying circuit further, and the 2nd digital disposal circuit which changes into a digital signal the signal amplified by this 2nd amplifying circuit, and inputs it into a data-processing circuit. A data-processing circuit by controlling electronic volume based on the 2nd input signal acquired from the 2nd digital disposal circuit While restricting the noise component which is detected by the sway sensor and amplified by the 1st amplifying circuit to fixed level, the existence of a theft is judged based on the 1st input signal and 2nd input signal which are acquired from the 1st digital disposal circuit, and it is characterized by outputting a theft detection signal.
[0011] By controlling electronic volume based on the 2nd input signal acquired from the 2nd digital disposal circuit according to this invention which has such a description Since it constituted so that the noise component which is detected by the sway sensor and amplified by the 1st amplifying circuit might always be restricted to fixed level For example, even if a sway sensor senses a noise oscillation in case an electric car passes near [in which this theft detection equipment was carried] the car, an oscillation in case rain is equivalent to a car body, etc., the oscillation by such ambient noise will always be restricted to fixed level. therefore, when the sway sensor has sensed the oscillation when touching a car body actually while detecting the oscillation by such ambient noise Since the oscillation at that time is inputted into a data-processing circuit as the 1st input signal from the 1st digital disposal circuit, in a data-processing circuit The existence of a theft can be certainly judged by calculating the level difference of the 1st input signal which shows the oscillation when actually touching a car body, and the 2nd input signal which shows the noise component by ambient noise. That is, the nonconformity of influencing and incorrect-detecting to ambient noise is not generated.
[0012] Moreover, according to the theft detection equipment of this invention, a data-processing circuit is characterized by outputting a theft detection signal, when the average value of a fixed period of the level of the 2nd input signal is compared with the level of the 1st input signal and the level of the 1st input signal is over said average value.
[0013] Since according to this invention which has such a description close can equalize the noise which

came and can hold it down on fixed level momentarily, the incorrect detection by such momentary noise can be prevented.
[0014] Moreover, according to the theft detection equipment of this invention, said data-processing circuit is characterized by not outputting a theft detection signal, when the condition that the level of the 1st input signal exceeds the average of a fixed period of the level of the 2nd input signal continues continuously.
[0015] For example, by raining, in the start etc., since rain is equivalent to a car body continuously, with a sway sensor, the oscillation by this rain will be detected continuously, but according to this invention, the incorrect detection by such noise component detected continuously can be prevented.
[0016] Moreover, according to the theft detection equipment of this invention, said data-processing circuit is characterized by not outputting a theft detection signal, when the time amount to which the level of the 1st input signal is over the average of a fixed period of the level of the 2nd input signal is measured and measurement time amount is over predetermined time.
[0017] Although the oscillation when striking a car body is based also on the thickness of the griddle of a car body in which the sway sensor is attached, the wave of a high frequency is detected momentarily and it serves as the pattern that a wave becomes blunt quickly after that. Therefore, when the signal of fixed level carries out predetermined time continuation and is measured, possibility of being the oscillation by some ambient noise rather is high rather than the signal relevant to a theft. According to this invention, the incorrect detection by the oscillation near such ambient noise can be prevented.
[0018]
[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained with reference to a drawing.
[0019] Drawing 1 is the block diagram showing the gestalt of 1 operation of the theft detection equipment of this invention.
[0020] The sway sensor 1 which detects the oscillation which joins the car with which this theft detection equipment is carried, The amplifying circuit 2 and amplifying circuit 3 of a two-step configuration which amplify the signal detected with this sway sensor 1, The electronic volume 4 which is the amplification factor control circuit which controls the amplification factor of the latter amplifying circuit 3 (volume for sensitivity settling), The filter circuit 5 which removes the noise component by ambient noise from the signal amplified by the latter amplifying circuit 3, The 1st digital disposal circuit 6 which changes the output signal of this filter circuit 5 into a digital signal, and inputs it into the data-processing circuit 9, It consists of the 2nd amplifying circuit 7 which amplifies the output signal of the latter amplifying circuit 3 further, and the 2nd digital disposal circuit 8 which changes into a digital signal the signal amplified by this 2nd amplifying circuit 7, and inputs it into the data-processing circuit 9.
[0021] As the 1st digital disposal circuit 6 and 2nd digital disposal circuit 8, the activity of an A/D converter or a comparator is possible. However, with the gestalt of this operation, it is considering as the A/D converter.
[0022] A filter circuit 5 is a band pass filter which passes the oscillation frequency produced when a car body is touched directly, and, specifically, cuts the frequency of 35Hz or less, and the frequency of about 20,000Hz or more. That is, the pass band width of a filter circuit 5 is set up possible [passage of almost all the frequency bands to the oscillation frequency obtained from the oscillation frequency obtained in the theft relation when attaching a sway sensor 1 in a light vehicle in the theft relation when attaching in a high-class car].
[0023] Moreover, a sway sensor 1 begins a bonnet, a fender, a roof, a trunk, a bumper, a door, a tire wheel, etc., and each part article of the circumference of a chassis and an engine etc. is attached in each part of a car body. That is, the sway sensor 1 attached in each part of a car body also detects oscillations by ambient noise, such as an oscillation when an electric car passes through near other than the oscillation relevant to the theft produced when a car body is touched directly, and an oscillation in case rain is equivalent to a car body.
[0024] So, with the gestalt of this operation, as described above, the two detection roots of the theft

oscillating detection root which detects the oscillation mainly relevant to a theft which consists of a sway sensor 1, amplifying circuits 2 and 3, a filter circuit 5, and the 1st digital disposal circuit 6, and the noise component detection root which mainly detects the noise component by ambient noise which consists of a sway sensor 1, amplifying circuits 2 and 3, the 2nd amplifying circuit 7, and the 2nd digital disposal circuit 8 are provided.

[0025] That is, since the 2nd amplifying circuit 7 is established in the noise component detection root in addition to the amplifying circuits 2 and 3 of the preceding paragraph and the latter part, the whole amplification factor is high compared with the theft oscillating detection root. Therefore, when the oscillating component by ambient noise is contained in the oscillation detected by the sway sensor 1, the effect of the oscillating component by this ambient noise will appear early in the noise component detection signal B from the theft oscillating detection signal A. That is, the noise component detection signal B will react more sensitively to the oscillation by ambient noise compared with the theft oscillating detection signal A.

[0026] For example, although a sway sensor 1 will detect the oscillation which becomes large gradually by access of this electric car on real time and this oscillation will be amplified to predetermined level in the amplifying circuits 2 and 3 of the preceding paragraph and the latter part when the car is stopped near the line and an electric car approaches from the direction of a long distance The noise component amplified to the predetermined level is amplified further in the 2nd amplifying circuit 7, is changed into a digital signal by the 2nd digital disposal circuit 8, and is inputted into the data-processing circuit 9 as a noise component detection signal B. Therefore, in the data-processing circuit 9, when an electric car is still in the distance, since the level of the noise component detection signal B begins to rise gradually, it becomes possible [starting control of a noise level in this stage] from from.

[0027] That is, it controls by the data-processing circuit 9 to lower the whole sensibility by controlling the electronic volume 4 and making low gradually the amplification factor of the latter amplifying circuit 3 so that the level of this noise component detection signal B is always supervised and the level of the noise component detection signal B turns into below the fixed level set up beforehand.

[0028] However, with the gestalt of this operation, the data-processing circuit 9 is not necessarily looking at the level of the noise component detection signal B inputted on real time, and looks at the average of fixed periods (for example, 3 etc. seconds etc.) of the level of the noise component detection signal B inputted. That is, since detection actuation of an oscillation becomes instability extremely, he is trying to see by the average of a fixed period by having answered the noise of the shape of the pulse and having controlled the electronic volume 4 so that it may not be influenced by the noise of the sudden shape of such a pulse when close has the pulse-like noise which came suddenly.

[0029] Thus, it is in the condition which is always controlling the level of a noise component below on fixed level, for example, when a suspicious person tends to strike a car body or tends to wrench a door open, a sway sensor 1 detects the oscillation at this time. Although this oscillation was inputted also into the data-processing circuit 9 as a noise component detection signal B through the amplifying circuits 2 and 3 of the preceding paragraph and the latter part, the 2nd amplifying circuit 7, and the 2nd digital disposal circuit 8, as it described above, since the level of the noise component detection signal B inputted is seen by the average value of a fixed period, this inputted oscillation does not influence control of a noise level immediately in the data-processing circuit 9.

[0030] On the other hand, the oscillation relevant to such a theft passes through a filter circuit 5 through the amplifying circuits 2 and 3 of the preceding paragraph and the latter part, is changed into a digital signal by the 1st digital disposal circuit 6, and is inputted into the data-processing circuit 9 as a theft oscillating detection signal A. The theft oscillating detection signal A at this time turns into a signal with high level.

[0031] Based on this theft oscillating detection signal A and the noise component detection signal B, the data-processing circuit 9 judges the existence of a theft, and outputs the theft detection signal D. Specifically, it is the average value LB of a fixed period of the level of the noise component detection signal B. Level LA of the theft oscillating detection signal A It compares and is the level LA of the theft oscillating detection signal A. Average value LB of the level of the noise component detection signal B

When having exceeded, the theft detection signal D is outputted.
[0032] Thereby, it becomes possible to detect certainly the oscillation when the oscillation relevant to a theft, i.e., a suspicious person, striking a car body, or wrenching a door open, without being influenced by the oscillation by ambient noise.
[0033] Next, detection actuation of the theft detection equipment of this invention is again explained using oscillating wave form chart (a) - (k) which was combined and was shown in drawing 1 .
[0034] For example, if an electric car approaches from the direction of a long distance when the car is stopped near the line, a sway sensor 1 will detect oscillating 21a which becomes large gradually by access of this electric car on real time, as shown in (a). after this oscillating 21a is amplified to predetermined level in the amplifying circuits 2 and 3 of the preceding paragraph and the latter part (sign 21b shows), and it is further amplified in the 2nd amplifying circuit 7 as shown in (c) so that it is alike and may be shown (sign 21c shows), it is changed into a digital signal by the 2nd digital disposal circuit 8, and is inputted into the data-processing circuit 9 as a noise component detection signal B. Average value LB of fixed periods (3 etc. seconds etc.) of the level of the noise component detection signal B inputted in the data-processing circuit 9 It asks by the operation and is this average value LB. It has and is the electronic volume 4. It controls. That is, the electronic volume 4 is controlled and it is the average value LB of a fixed period of the level of the noise component detection signal B. It is controlling to be set to zero or less fixed level LB set up beforehand (refer to (d)).
[0035] And when a suspicious person tends to strike a car body or tends to wrench a door open, as it is in the condition which does in this way and is always controlling the level of a noise component on zero or less fixed level LB, for example, it is shown in (e), a sway sensor 1 detects oscillating 31a at this time.
[0036] This oscillating 31a is inputted also into the data-processing circuit 9 as a noise component detection signal B through the amplifying circuits 2 and 3 of the preceding paragraph and the latter part, the 2nd amplifying circuit 7, and the 2nd digital disposal circuit 8 (sign 31c in sign 31b in (f) and (g) shows). However, since the level of the noise component detection signal B inputted is seen by the average value of a fixed period in the data-processing circuit 9, even if high oscillating 31c of level is inputted, when it sees by the average value of a fixed period, as it is shown in (h), it is an average value LB. Level ends with extent which rises a little.
[0037] On the other hand, oscillating 31a relevant to such a theft passes through a filter circuit 5 through the amplifying circuits 2 and 3 of the preceding paragraph and the latter part (31d of signs in (i) shows), is changed into a digital signal by the 1st digital disposal circuit 6, and is inputted into the data-processing circuit 9 as a theft oscillating detection signal A. The theft oscillating detection signal A at this time turns into a signal with high level, as shown in (j).
[0038] The data-processing circuit 9 is the average value LB of the noise component detection signal B. Level LA of the theft oscillating detection signal A It compares (k), It is the level LA of the theft oscillating detection signal A so that it may be shown. Average value LB of the level of the noise component detection signal B When having exceeded, the theft detection signal D is outputted. Thereby, the oscillation relevant to a theft can be detected certainly, without being influenced by the oscillation by ambient noise.
[0039] In addition, in the data-processing circuit 9, it is the level LA of the theft oscillating detection signal A. The average LB of the level of the noise component detection signal B Since the possibility of the incorrect detection by ambient noise is high in [for example, the case like an intense shower] when the condition of exceeding continues continuously (refer to drawing 2), the theft detection signal D is not outputted. Moreover, level LA of the theft oscillating detection signal A The average LB of the level of the noise component detection signal B Since the possibility of the incorrect detection by ambient noise is high also when the time amount which has exceeded is measured and measurement time amount is over predetermined time t1 (for example, 2.0 etc.ms etc.) (refer to drawing 3) (for example, when a tree and a stone collide), the theft detection signal D is outputted.
[0040] In addition, although the gestalt of the above-mentioned implementation explains the case where an A/D converter is used as the 1st digital disposal circuit 6 and 2nd digital disposal circuit 8, in using a

comparator, it becomes circuitry as shown in drawing 4 . Namely, about the comparator by the side of the 1st digital disposal circuit 6, the level of reference voltage can be controlled now by making possible adjustable [of the resistance of variable resistance VR 2] by the data-processing circuit 9. That is, the data-processing circuit 9 is the average LB of the level of the noise component detection signal B. Since a noise component may be inputted also into the 1st digital disposal circuit 6 through a filter circuit 5 when going up, it is the average LB. Level of the reference voltage of a comparator 6 is made high with lifting. This has prevented detecting a noise component as a theft oscillating detection signal A.

[0041]

[Effect of the Invention] By controlling electronic volume based on the 2nd input signal acquired from the 2nd digital disposal circuit according to the theft detection equipment of this invention Since it constituted so that the noise component which is detected by the sway sensor and amplified by the 1st amplifying circuit might always be restricted to fixed level For example, even if a sway sensor senses a noise oscillation in case an electric car passes near [in which this theft detection equipment was carried] the car etc., such a noise-oscillation will always be restricted to fixed level. therefore, when the sway sensor has sensed the oscillation when touching a car body actually while detecting such a noise-oscillation Since the oscillation at that time is inputted into a data-processing circuit as the 1st input signal from the 1st digital disposal circuit, in a data-processing circuit The existence of a theft can be certainly judged by calculating the level difference of the 1st input signal which shows the oscillation when actually touching a car body, and the 2nd input signal which shows a noise-noise component. That is, it is influenced by the noise component and the nonconformity of incorrect-detecting is not generated. Moreover, since almost all the frequency bands from the oscillation frequency when attaching a sway sensor in a light vehicle to the oscillation frequency when attaching in a high-class car are set up possible [passage], the pass band width of a filter circuit can respond to all types of a car with the theft detection equipment of this invention.

[0042] According to the theft detection equipment of this invention, moreover, a data-processing circuit When the average value of a fixed period of the level of the 2nd input signal is compared with the level of the 1st input signal and the level of the 1st input signal is over said average value Since it constituted so that a theft detection signal might be outputted, and close can equalize the noise which came and can hold it down on fixed level momentarily, the incorrect detection by such momentary noise can be prevented.

[0043] Moreover, according to the theft detection equipment of this invention, when the condition that the level of the 1st input signal exceeds the average of a fixed period of the level of the 2nd input signal continues continuously, the data-processing circuit is constituted so that a theft detection signal may not be outputted. By raining, in the start etc., since rain is equivalent to a car body continuously, this will detect the oscillation by this rain continuously with a sway sensor, but according to this invention, the incorrect detection by such noise component detected continuously can be prevented.

[0044] Moreover, according to the theft detection equipment of this invention, when the time amount to which the level of the 1st input signal is over the average of a fixed period of the level of the 2nd input signal is measured and measurement time amount is over predetermined time, the data-processing circuit is constituted so that a theft detection signal may not be outputted. That is, since possibility of being the oscillation by some ambient noise rather rather than the signal relevant to a theft is high when the signal of fixed level carries out predetermined time continuation and is measured, according to this invention, the incorrect detection by the oscillation with the high possibility of such ambient noise can be prevented.

[Translation done.]

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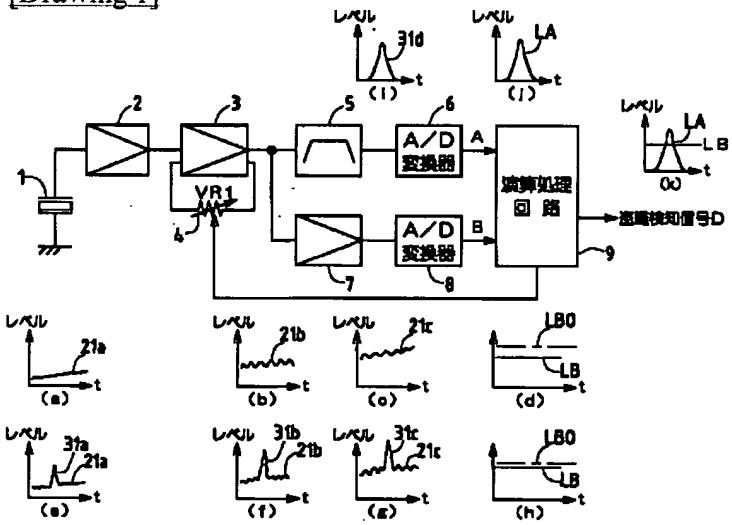
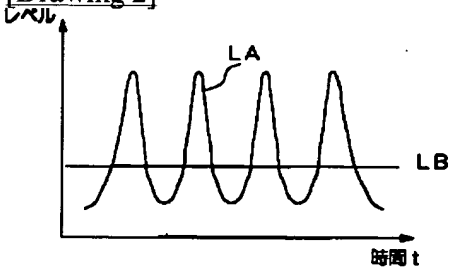
DRAWINGS

[Drawing 1]



[Drawing 2]



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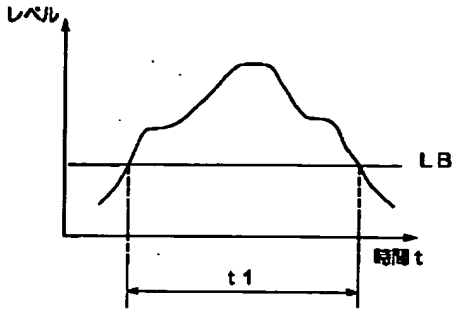

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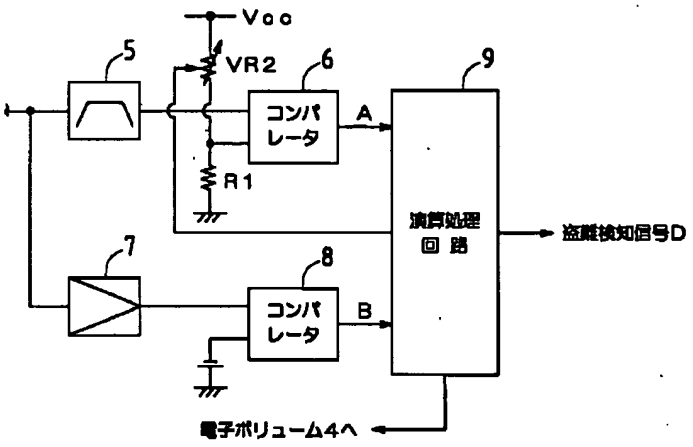

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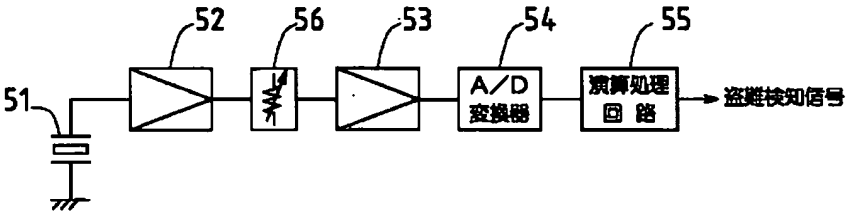

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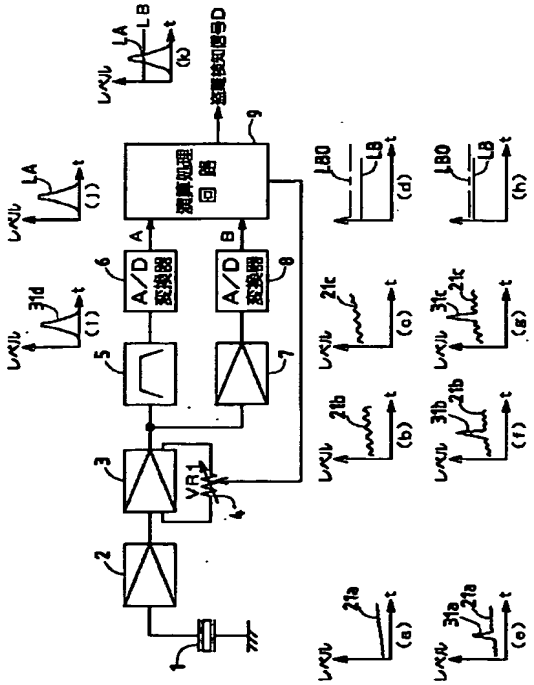
(54)【発明の名称】　盗難検知装置

(57)【要約】
【課題】　感度調整を自動で行うことにより、全ての車種に適用でき、かつ、雑音を確実に除去して、実際に車体に触れたときの振動のみを確実に検知する。
【解決手段】　演算処理回路９は、Ａ／Ｄ変換器８より得られるノイズ成分検知信号Ｂに基づいて電子ボリューム４を制御することにより、振動センサ１によって検知され増幅回路２，３によって増幅される環境騒音によるノイズ成分を一定レベルに制限するとともに、Ａ／Ｄ変換器６より得られる盗難振動検知信号Ａのレベルと、ノイズ成分検知信号Ｂのレベルの一定期間の平均値とを比較し、盗難振動検知信号Ａのレベルが、ノイズ成分検知信号Ｂのレベルの一定期間の平均値を超えているときには、盗難検知信号Ｄを出力する。



処理と、高級車両に対応した処理とに分けて行っていた。すなわち、軽車両は軽車両用に感度が設定された盗難検知装置を使用し、高級車両は高級車両用に感度が設定された盗難検知装置を使用する必要があり、１種類の盗難検知装置で全ての車種に対応することができないといった問題があった。

【０００９】本発明はかかる問題点を解決すべく創案されたもので、その目的は、感度調整を自動で行うことにより、全ての車種に適用でき、かつ、雑音を確実に除去して、実際に車体に触れたときの振動のみを確実に検知することのできる盗難検知装置を提供することにある。

【００１０】

【課題を解決するための手段】上記課題を解決するため、本発明の盗難検知装置は、車両等に加わる振動を検知する振動センサと、振動センサにより検知した信号を増幅する第１の増幅回路と、この第１の増幅回路の増幅率を制御する増幅率制御回路である電子ボリュームと、第１の増幅回路の出力信号から環境騒音によるノイズ成分を除去するフィルタ回路と、このフィルタ回路の出力信号をデジタル信号に変換して演算処理回路に入力する第１の信号処理回路と、第１の増幅回路の出力信号をさらに増幅する第２の増幅回路と、この第２の増幅回路により増幅された信号をデジタル信号に変換して演算処理回路に入力する第２の信号処理回路とを備え、演算処理回路は、第２の信号処理回路より得られる第２の入力信号に基づいて電子ボリュームを制御することにより、振動センサによって検知され第１の増幅回路によって増幅されるノイズ成分を一定レベルに制限するとともに、第１の信号処理回路より得られる第１の入力信号と第２の入力信号とに基づいて盗難の有無を判定し、盗難検知信号を出力することを特徴とする。

【００１１】このような特徴を有する本発明によれば、第２の信号処理回路より得られる第２の入力信号に基づいて電子ボリュームを制御することにより、振動センサによって検知され第１の増幅回路によって増幅されるノイズ成分を常に一定レベルに制限するように構成したので、例えば、この盗難検知装置を搭載した車両の近くを電車が通過するときの騒音振動や、雨が車体に当たるときの振動などを振動センサが感知したとしても、そのような環境騒音による振動は、常に一定レベルに制限されることになる。そのため、このような環境騒音による振動を検知しているときに、実際に車体に触れたときの振動を振動センサが感知したときには、そのときの振動が第１の信号処理回路より第１の入力信号として演算処理回路に入力されるので、演算処理回路では、実際に車体に触れたときの振動を示す第１の入力信号と、環境騒音によるノイズ成分を示す第２の入力信号とのレベル差を演算することにより、盗難の有無を確実に判定することができる。つまり、環境騒音に影響されて誤検知してしまうといった不具合は発生しない。

【００１２】また、本発明の盗難検知装置によれば、演算処理回路は、第２の入力信号のレベルの一定期間の平均値と第１の入力信号のレベルとを比較し、第１の入力信号のレベルが前記平均値を超えているときには、盗難検知信号を出力することを特徴とする。

【００１３】このような特徴を有する本発明によれば、瞬間的に入ってきたノイズを平準化して一定レベルに抑え込むことができるので、このような瞬間的なノイズによる誤検知を防止することができる。

【００１４】また、本発明の盗難検知装置によれば、前記演算処理回路は、第１の入力信号のレベルが第２の入力信号のレベルの一定期間の平均値を超える状態が連続して続く場合には、盗難検知信号を出力しないことを特徴とする。

【００１５】例えば、雨の降り始めなどの場合には、雨が車体に連続的に当たるため、振動センサではこの雨による振動を連続的に検知することになるが、本発明によれば、このような連続的に検知されるノイズ成分による誤検知を防止することができる。

【００１６】また、本発明の盗難検知装置によれば、前記演算処理回路は、第１の入力信号のレベルが第２の入力信号のレベルの一定期間の平均値を超えている時間を計測し、計測時間が所定時間を超えている場合には、盗難検知信号を出力しないことを特徴とする。

【００１７】車体を叩いたときの振動は、振動センサが取り付けられている車体の鉄板の厚みにもよるが、高い周波数の波形が瞬間的に検知され、その後波形が急速に鈍っていくといったパターンとなる。従って、一定レベルの信号が所定時間連続して計測される場合には、盗難に関連した信号というよりも、むしろ何かの環境騒音による振動である可能性が高い。本発明によれば、このような環境騒音に近い振動による誤検知を防止することができる。

【００１８】

【発明の実施の形態】以下、本発明の実施の形態について、図面を参照して説明する。

【００１９】図１は、本発明の盗難検知装置の一実施の形態を示すブロック図である。

【００２０】この盗難検知装置は、搭載されている車両等に加わる振動を検知する振動センサ１と、この振動センサ１により検知した信号を増幅する２段構成の増幅回路２および増幅回路３と、後段の増幅回路３の増幅率を制御する増幅率制御回路である電子ボリューム（感度調整用ボリューム）４と、後段の増幅回路３により増幅された信号から環境騒音によるノイズ成分を除去するフィルタ回路５と、このフィルタ回路５の出力信号をデジタル信号に変換して演算処理回路９に入力する第１の信号処理回路６と、後段の増幅回路３の出力信号をさらに増幅する第２の増幅回路７と、この第２の増幅回路７により増幅された信号をデジタル信号に変換して演算処理回

（ａ）～（ｋ）を用いて、本発明の盗難検知装置の検知動作を、再度説明する。

【００３４】例えば、線路のそばに車両を止めていた場合に、遠くの方から電車が近づいてくると、振動センサ１は、（ａ）に示すように、この電車の接近により徐々に大きくなっていく振動２１ａをリアルタイムに検知する。この振動２１ａは、に示すように、前段および後段の増幅回路２，３で所定レベルまで増幅され（符号２１ｂにより示す）、さらに、（ｃ）に示すように、第２の増幅回路７でさらに増幅された後（符号２１ｃにより示す）、第２の信号処理回路８でデジタル信号に変換されて、ノイズ成分検知信号Ｂとして演算処理回路９に入力される。演算処理回路９では、入力されるノイズ成分検知信号Ｂのレベルの一定期間（３秒等）の平均値ＬＢ を演算により求め、この平均値ＬＢ でもって電子ボリューム4 を制御するようになっている。つまり、電子ボリューム４を制御して、ノイズ成分検知信号Ｂのレベルの一定期間の平均値ＬＢ が、予め設定された一定レベルＬＢ0以下となるように制御している（（ｄ）参照）。

【００３５】そして、このようにしてノイズ成分のレベルを常に一定レベルＬＢ0以下に制御している状態で、例えば、不審者が車体を叩いたり、ドアをこじ開けようとした場合には、（ｅ）に示すように、振動センサ１がこのときの振動３１ａを検知する。

【００３６】この振動３１ａは、前段および後段の増幅回路２，３、第２の増幅回路７および第２の信号処理回路８を経て（（ｆ）中の符号３１ｂ、（ｇ）中の符号３１ｃにより示す）、ノイズ成分検知信号Ｂとして演算処理回路９にも入力される。しかしながら、演算処理回路９では、入力されるノイズ成分検知信号Ｂのレベルを一定期間の平均値で見ているため、レベルの高い振動３１ｃが入力されても、一定期間の平均値で見たときには、（ｈ）に示すように、平均値ＬＢ のレベルが若干上昇する程度ですむ。

【００３７】一方、このような盗難に関連する振動３１ａは、前段および後段の増幅回路２，３を経てフィルタ回路５を通過し（（ｉ）中の符号３１ｄにより示す）、第１の信号処理回路６でデジタル信号に変換されて盗難振動検知信号Ａとして演算処理回路９に入力される。このときの盗難振動検知信号Ａは、（ｊ）に示すように、レベルの高い信号となる。

【００３８】演算処理回路９は、ノイズ成分検知信号Ｂの平均値ＬＢ と、盗難振動検知信号Ａのレベル ＬＡ とを比較し、（ｋ）に示すように、盗難振動検知信号Ａのレベル ＬＡ がノイズ成分検知信号Ｂのレベルの平均値ＬＢ を超えているときには、盗難検知信号Ｄを出力する。これにより、環境騒音による振動に影響されることなく、盗難に関連した振動を確実に検知することができる。

【００３９】なお、演算処理回路９では、盗難振動検知信号Ａのレベル ＬＡ がノイズ成分検知信号Ｂのレベルの平均値ＬＢ を超える状態が連続して続く場合（図２参照）には、環境騒音（例えば、激しい夕立のような場合）による誤検知の可能性が高いので、盗難検知信号Ｄを出力しない。また、盗難振動検知信号Ａのレベル ＬＡ がノイズ成分検知信号Ｂのレベルの平均値ＬＢ を超えている時間を計測し、計測時間が所定時間ｔ１（例えば、２．０ｍｓ等）を超えている場合（図３参照）にも、環境騒音（例えば、木や石がぶつかったような場合）による誤検知の可能性が高いので、盗難検知信号Ｄを出力しないようになっている。

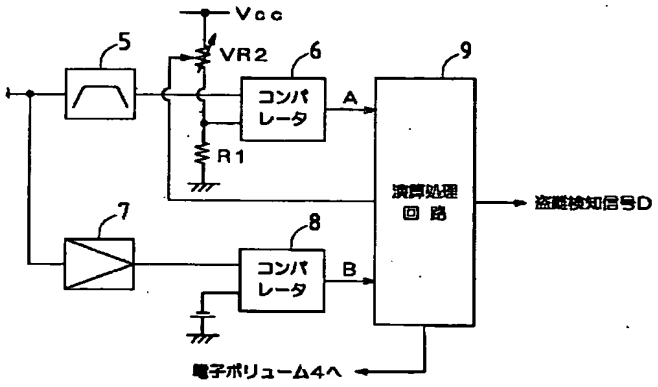
【００４０】なお、上記実施の形態では、第１の信号処理回路６および第２の信号処理回路８としてＡ／Ｄ変換器を使用した場合について説明しているが、コンパレータを使用する場合には、図４に示すような回路構成となる。すなわち、第１の信号処理回路６側のコンパレータについては、演算処理回路９により可変抵抗ＶＲ２の抵抗値を可変可能とすることにより、基準電圧のレベルを制御できるようになっている。すなわち、演算処理回路９は、ノイズ成分検知信号Ｂのレベルの平均値ＬＢ が上昇していく場合には、ノイズ成分がフィルタ回路５を経て第１の信号処理回路６にも入力される可能性があるので、平均値ＬＢ の上昇に伴いコンパレータ６の基準電圧のレベルを高くしていく。これにより、ノイズ成分を盗難振動検知信号Ａとして検知することを防止している。

【００４１】

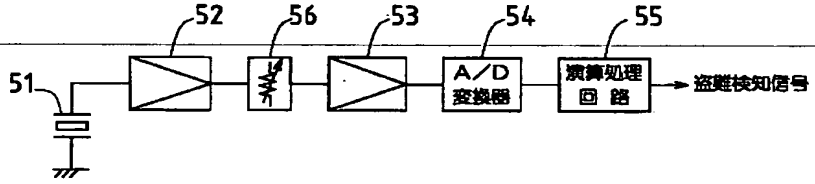
【発明の効果】本発明の盗難検知装置によれば、第２の信号処理回路より得られる第２の入力信号に基づいて電子ボリュームを制御することにより、振動センサによって検知され第１の増幅回路によって増幅されるノイズ成分を常に一定レベルに制限するように構成したので、例えば、この盗難検知装置を搭載した車両の近くを電車が通過するときの騒音振動などを振動センサが感知したとしても、そのような雑音的な振動は、常に一定レベルに制限されることになる。そのため、このような雑音的な振動を検知しているときに、実際に車体に触れたときの振動を振動センサが感知したときには、そのときの振動が第１の信号処理回路より第１の入力信号として演算処理回路に入力されるので、演算処理回路では、実際に車体に触れたときの振動を示す第１の入力信号と、雑音的なノイズ成分を示す第２の入力信号とのレベル差を演算することにより、盗難の有無を確実に判定することができる。つまり、雑音成分に影響されて誤検知してしまうといった不具合は発生しない。また、フィルタ回路の通過帯域幅は、振動センサを軽車両に取り付けたときの振動周波数から、高級車両に取り付けたときの振動周波数までのほぼ全ての周波数帯が通過可能に設定されているので、本発明の盗難検知装置で全ての車種に対応することができる。

【００４２】また、本発明の盗難検知装置によれば、演算処理回路は、第２の入力信号のレベルの一定期間の平

【図4】


Vcc
5
VR2
6
コンパレータ
A
9
R1
演算処理回路
盗難検知信号D
7
8
コンパレータ
B
電子ボリューム4へ

【図5】


52
56
53
54
55
51
A/D変換器
演算処理回路
盗難検知信号